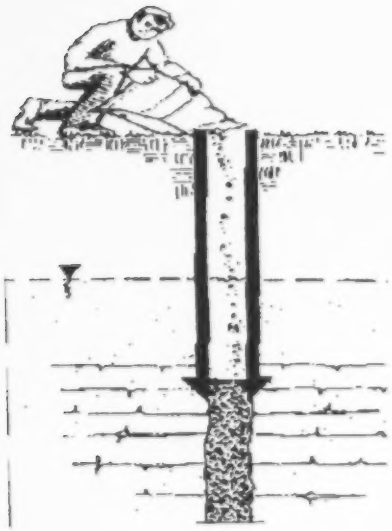
Guidelines For
Sealing Groundwater Wells



GOVERNMENT OF
NEWFOUNDLAND
AND LABRADOR

Department of Environment

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Guidelines For Sealing Groundwater Wells

Water Resources Management Division
Groundwater Section
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1.0 INTRODUCTION

A sealed well is "one in which the vertical movement of water or gas within the well bore and the annular space surrounding the casing is effectively and permanently prevented, and that water is permanently confined to the specific zone in which it originally occurred." Hence, the well is restored, as far as is possible, to the original hydrological conditions.

Unsealed abandoned wells are a hazard to public health and the preservation of our groundwater resources. Abandoned wells must be carefully sealed to:

- prevent pollution of groundwater;
- conserve aquifer yield and artesian pressure;
- prevent poor quality groundwater from moving between water-bearing zones;
- remove liability; and
- remove any physical hazard.

In order to prevent the vertical movement of water or gas in the well between the ground surface and an aquifer, or between aquifers, the abandoned well must be sealed by approved procedures using suitable materials. Proper well sealing practices and materials are as important as those used to construct the well in the first place. Therefore, it makes good sense to require the sealing procedure to be done by a qualified groundwater professional; i.e. one who is familiar with well construction practices and local hydrogeologic conditions. The Department of Environment recommends that a licenced water well driller carry out the well sealing procedures outlined herein.

2.0 LEGISLATION

The *Water Resources Act SNL 2002 cW-4.01* gives the Water Resources Management Division of the Department of Environment the responsibility and legislative power for the management of water resources including groundwater in the province.

Section 18. (1) of the *Well Drilling Regulations* under the *Water Resources Act* requires the owner of a water well to maintain the well at all times in a manner to prevent pollution from entering the well. Section 18. (1) states:

> "The owner of a well shall maintain the well at all times after its completion date in a manner sufficient to prevent the entry of surface water and other foreign materials into the well."

Section 18. (3) of the *Well Drilling Regulations* requires the owner of an abandoned well to seal that well in a manner approved by the Department of Environment. Section 18. (3) states:

> "Where a well is dry or abandoned and its continued existence might result in the impairment of groundwater, the owner shall fill and seal the well in a manner sufficient to prevent the vertical movement of water in it by a method approved by the minister."

3.0 WELLS REQUIRED TO BE SEALED

The conditions under which a water well must be sealed are:

- where a well is dry;
- where a well is not being used or maintained for future use;
- where a well is producing salty, sulphurous or mineralized water, or water that is otherwise not potable;
- where a well encounters natural gas; or
- where a well is constructed in contravention of any provisions of the *Water Resources Act* or the *Well Drilling Regulations* dealing with the spacing of wells, the method and materials used in the construction of wells or the standards of well construction.

4.0 SEALING PROCEDURE

These guidelines are set forth by the Department of Environment to properly seal an abandoned well, unsuccessful well, test well, or contaminated well. The following procedure has been developed to cover most of the well conditions generally found in this province. However, there are special conditions, such as the occurrence of saltwater, that may require the use of alternate procedures and/or materials.

In all situations, materials used to seal a well must be placed in such a manner to ensure that bridging, segregation or dilution of the sealing materials does not occur. Dumping from the well head is not permitted.

The sealing of a well under general hydrogeological conditions must be conducted as follows and as shown in Figure 1:

1. All obstructions in the well shall be removed prior to commencing to seal the well.

2. The well bore shall be filled to within 3 m (10 ft) of the well casing with alternating layers of 19 mm (3/4 in.) grade granular bentonite and clean coarse sand. The lower 10 m (33 ft) of well bore shall be filled with granular bentonite. The thickness of intermediate granular bentonite layers shall not be less than 1.5 m (5 ft), and the individual course sand layers shall not be more than 5 m (16 ft). To prevent bridging within the bore hole, it is recommended that these materials be poured at a rate not to exceed 2 minutes per 22.7 kg (50 lb) bag, or that these materials be poured through a 51 mm (2 in.) orifice.

3. The upper portion of the well, consisting of a depth equal to the casing length plus 3 m (10 ft), shall be filled with granular bentonite only.

4. Well casing and well screens should be removed. In removing well casing, the casing

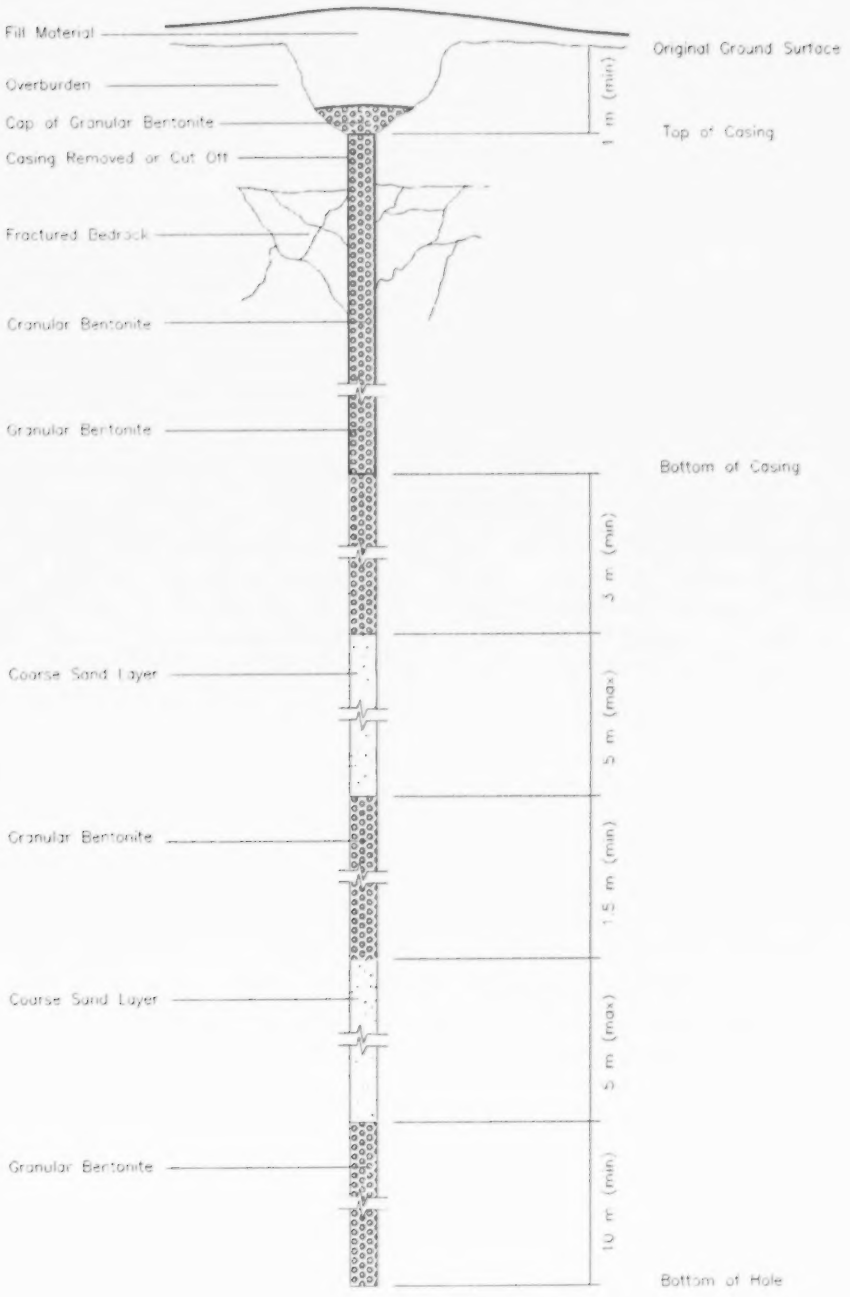

Figure 1. Well Properly Sealed Under General Conditions

shall be kept full of granular bentonite as the casing is being pulled. At all times it must be ensured that the granular bentonite is flowing unrestricted from the lower end of the casing; i.e., that bridging of the bentonite is not occurring within the casing.

5. If it is not possible to remove the well casing, it shall be sealed, as in Step 3 above, and its upper portion cut off to a minimum of 1 m (3 ft) below ground level. Granular bentonite shall be used to form a sealed cap at the well head.

6. The sealed well shall be covered to ground surface with material suitable for the intended land use and graded to direct surface drainage away from the well.

5.0 SPECIAL CONDITIONS

The above procedure covers general conditions which will be encountered in sealing drilled water wells within Newfoundland and Labrador. However, where high concentrations of salt water (greater than 10,000 mg/L of chloride) are suspected, bentonite may not provide an effective seal.

In the case of seawater intrusion, the elevation of the fresh/salt water interface must be determined. That portion of the well below the fresh/salt water interface shall be filled with non-shrinking cement grout only. After cementing, the salt water in the well must be removed. That portion of the well above the elevation of the fresh/salt water interface must then be filled with granular bentonite only. The casing should be removed or cut off and capped as outlined in Section 4.0.

Wells, which are contaminated by hydrocarbons or other chemicals, require special care in sealing. In such cases, the Department of Environment must be consulted before attempting to seal the contaminated well. In general, these wells shall be filled completely from the bottom to the surface with 19 mm (3/4 in.) grade granular bentonite. Care must be taken when placing the bentonite to prevent the granules from being coated with the hydrocarbon contaminant. The casing should be removed or cut off and capped as outlined in Section 4.0.

Mineral exploration holes, ground source heat pump holes, dewatering wells, temporary service wells, etc., which have fulfilled their useful purpose, must also be sealed according to the above stated standards for water supply wells.

6.0 COMPLETION REPORT

Upon completion, all information relevant to the well sealing process must be forwarded within 30 days to the Department of Environment by the person or contractor carrying out the work. The well sealing report shall include the following information:

- date well was sealed;
- name and address of well owner/property owner;
- location of property;
- location of abandoned well on the property (include a minimum of three measured distances from permanent landmarks/structures on the property);
- reason for abandonment;
- well identification number if available;
- depth and diameter of well;
- description of well sealing procedure carried out;
- total amount of bentonite used;
- total amount of sand used;
- all other materials used;
- proof of purchase (receipts) of sealing materials used; and
- name, address and signature of the person completing the work.

7.0 OTHER CONSIDERATIONS

Because of the complexities involved in some cases of sealing a well, each well should be considered on a site specific basis. The design, construction of the well, and the hydrogeology must be considered and studied before the selection of materials, methods, and procedures are finalized. It would be wise, where there is doubt as to well construction or hydrogeology, to adopt those materials and procedures which will give the greatest possible chance for a successful and permanent sealing operation.

Any deviation from these guidelines must have prior approval from the Department of Environment before undertaking the work.

8.0 CONTACT

For clarification or further information please write or call:

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